

## \* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention relates to the alkali rechargeable battery which improved the negative electrode which contains occlusion, the hydrogen storing metal alloy to emit, and this hydrogen storing metal alloy for hydrogen electrochemically.

#### [0002]

[Description of the Prior Art] As a high capacity rechargeable battery, the nickel cadmium rechargeable battery and the nickel hydrogen rechargeable battery are known. Among these, the nickel hydrogen rechargeable battery equipped with the negative electrode which contains occlusion and the hydrogen storing metal alloy to emit for hydrogen is widely used for portable electronic equipment etc. as a small sealing rechargeable battery excellent in environmental compatibility.

[0003] In said nickel hydrogen rechargeable battery, what mixed a small amount of cobalt hydroxide or cobalt oxide is used for nickel hydroxide as positive active material. Moreover, as a hydrogen storing metal alloy which plays a role important as a negative-electrode active material, it is mainly MmNi5. The alloy of a system (Mm; misch metal) or TiMn2 system is used.

[0004] By the way, in nickel and a hydrogen rechargeable battery, much more high-capacity-izing and reinforcement are called for from the point of the improvement in the engine performance of the portable device incorporating this rechargeable battery. Approaches, such as making [ many ] raising an actual discharge capacity (utilization factor) to the geometric capacity of a positive electrode and the amount of positive active material to the demand of such high-capacity-izing, have been adopted conventionally. However, in the approach of raising a utilization factor, the present condition and since geometric capacity is reached mostly, the further high-capacity-izing is difficult. Moreover, when making [ many ] the amount of positive active material, in order to intervene a separator between a positive electrode and a negative electrode, for example, to store the bottom electrode group of winding in the cell container of the fixed volume at a curled form, it is necessary to make small the volume which a negative-electrode active material occupies relatively, and a hydrogen storing metal alloy with a bigger discharge capacity is desired.

[0005] However, MmNi5 mentioned above The limitation was in the hydrogen absorption capacity which said hydrogen storing metal alloy has in the nickel hydrogen rechargeable battery equipped with the negative electrode containing the hydrogen storing metal alloy of a system (Mm; misch metal) or TiMn2 system, and much more high-capacity-izing was difficult.

[0006] Since it is such, the hydrogen storing metal alloy of a V-Ti system, a TiFe system, and a Ti2nickel system is developed. However, although the direct reaction nature with the hydrogen gas under an elevated temperature was excellent, these hydrogen storing metal alloys were deficient in reactivity with the hydrogen under ordinary temperature ordinary pressure, and had the problem that initial-activity-izing was difficult.

[0007] On the other hand, the hydrogen storing metal alloy which contains magnesium, nickel, and rare earth elements as a main configuration element is MmNi5 put in practical use widely. It has the

description of both the capacity consistency per volume and the capacity consistency per mass being high compared with a system alloy, and activation being quicker than a TiMn2 system alloy, and excelling in the high charge-and-discharge property. For this reason, it is MmNi5 by using the negative electrode containing said hydrogen storing metal alloy. It becomes possible to realize the rechargeable battery which was excellent in the high charge-and-discharge property compared with the case where the negative electrode which contains a TiMn2 system alloy by high capacity is used compared with the case where the negative electrode containing a system alloy is used.

[0008]

[Problem(s) to be Solved by the Invention] However, the alkali rechargeable battery equipped with the negative electrode containing the hydrogen storing metal alloy which contains magnesium, nickel, and rare earth elements as a main configuration element had the problem that said hydrogen storing metal alloy oxidized and a cycle life fell.

[0009] This invention has the outstanding oxidation resistance, and has low temperature and hydrogen absorption nature high at an elevated temperature, and tends to maintain sufficient hydrogen storage capacity in the repeat of occlusion and emission, and tends to offer the hydrogen storing metal alloy which has a still higher hydrogen absorption rate.

[0010] It tends to offer the long alkali rechargeable battery of a charge-and-discharge cycle life, this invention being equipped with the negative electrode containing the hydrogen storing metal alloy which has said outstanding property, and realizing high capacity-ization.

[0011]

[Means for Solving the Problem] The hydrogen storing metal alloy concerning this invention is general formula  $Ln_{1-x}Mgx(nickel_{1-y}Ty)_z$  (however,  $Ln(s)$  in a formula are a lanthanoids and at least one element chosen from calcium, Sr, Sc, Y, Ti, Zr, and Hf). And at least one element with which the amount of  $La(s)$  occupied to  $Ln$  is ten to 50 atom %, and T is chosen from Li, V, Nb, Ta, Cr, Mo, Mn, Fe, Co, aluminum, Ga, Zn, Sn, In, Cu, Si, P, and B, x, and y and z show  $0.05 \leq x \leq 0.20$ ,  $0 \leq y \leq 0.5$ , and  $2.8 \leq z \leq 3.9$ , respectively, and are expressed.

[0012] The alkali rechargeable battery concerning this invention is characterized by having a negative electrode containing the hydrogen storing metal alloy mentioned above.

[0013]

[Embodiment of the Invention] Hereafter, the hydrogen storing metal alloy concerning this invention is explained.

[0014] This hydrogen storing metal alloy is general formula  $Ln_{1-x}Mgx(nickel_{1-y}Ty)_z$  (however,  $Ln(s)$  in a formula are a lanthanoids and at least one element chosen from calcium, Sr, Sc, Y, Ti, Zr, and Hf). And at least one element with which the amount of  $La(s)$  occupied to  $Ln$  is ten to 50 atom %, and T is chosen from Li, V, Nb, Ta, Cr, Mo, Mn, Fe, Co, aluminum, Ga, Zn, Sn, In, Cu, Si, P, and B, x, and y and z show  $0.05 \leq x \leq 0.20$ ,  $0 \leq y \leq 0.5$ , and  $2.8 \leq z \leq 3.9$ , respectively, and are expressed.

[0015] Especially in  $Ln$  of said general formula, a lanthanoids is desirable.

[0016] Having specified the amount of  $La(s)$  occupied in said  $Ln$  has a possibility that the hydrogen storage capacity in an elevated temperature may fall remarkably, when the amount of  $La(s)$  is made under into 10 atom %. On the other hand, when the amount of  $La(s)$  exceeds 50 atom %, a homogeneous organization becomes is hard to be obtained, and there is a possibility that the hydrogen absorption rate of a hydrogen storing metal alloy may fall remarkably. The amount of  $La(s)$  in more desirable  $Ln$  is 20 to 40 atom %.

[0017] Having specified x of said general formula has a possibility that a different alloy phase from the alloy phase made into the purpose may become easy to deposit, and a hydrogen storage capacity may fall remarkably, when x is made less than into 0.05. On the other hand, when x becomes 0.2 or more, there is a possibility that the content of the magnesium which is the element which is easy to oxidize may increase, and the oxidation resistance of a hydrogen storing metal alloy may fall remarkably. More desirable x is  $0.10 \leq x \leq 0.15$ .

[0018] Having specified y in said general formula has a possibility that the hydrogen storage capacity in an elevated temperature may fall remarkably, when y exceeds 0.5. More desirable y is  $0 \leq y \leq 0.2$ .

[0019] Having specified z in said general formula has a possibility that a different alloy phase from the alloy phase made into the purpose may increase, the residual hydrogen accompanying the repeat of hydrogen absorption may increase, and a hydrogen storage capacity may fall remarkably, when z is made less than into 2.8. On the other hand, when z exceeds 3.9, there is a possibility that the hydrogen storage capacity in an elevated temperature may fall remarkably. More desirable z is  $3.0 \leq z \leq 3.6$ .

[0020] It is expressed with general formula  $Ln_{1-x}Mgx(\text{nickel}_{1-y}Ty)z$ , and a homogeneous alloy presentation is acquired by specifying the amount of La(s) in Ln to 10 - 50 atom %, and the hydrogen storing metal alloy concerning this invention explained above can demonstrate a high hydrogen absorption rate. Moreover, oxidation-resistant improvement and increase of a hydrogen absorption rate can be aimed at by specifying x of said general formula to  $0.05 \leq x \leq 0.20$ . By specifying y in said general formula to  $0 \leq y \leq 0.5$ , the hydrogen absorption nature in low temperature can be raised. furthermore, the hydrogen absorption nature in an elevated temperature can be raised by specifying z in said general formula to  $2.8 \leq z \leq 3.9$  -- in the repeat of the occlusion and emission of hydrogen, sufficient hydrogen storage capacity is [ both ] maintainable.

[0021] Therefore, it has the outstanding oxidation resistance, and has low temperature and hydrogen absorption nature high at an elevated temperature, and sufficient hydrogen storage capacity can be maintained in the repeat of occlusion and emission, and the hydrogen storing metal alloy which has a still higher hydrogen absorption rate can be obtained.

[0022] Next, the alkali rechargeable battery (for example, cylindrical shape alkali rechargeable battery) concerning this invention is explained with reference to drawing 1.

[0023] In the closed-end cylinder-like container 1, the electrode group 5 produced by carrying out the laminating of a positive electrode 2, a separator 3, and the negative electrode 4, and winding in the shape of a spiral is contained. Said negative electrode 4 is arranged at the outermost periphery of said electrode group 5, and touches said container 1 electrically. The alkali electrolytic solution is held in said container 1.

[0024] The circular obturation plate 7 which has a hole 6 in the center is arranged at up opening of said container 1. The insulating ring-like gasket 8 is arranged between the periphery of said obturation plate 7, and the up opening circles side of said container 1, and is fixing said obturation plate 7 to said container 1 airtightly through said gasket 8 by caulking processing which reduces the diameter of said up opening inside. An end is connected to said positive electrode 2, and, as for the positive-electrode lead 9, connection and the other end are connected to the inferior surface of tongue of said obturation plate 7. The positive-electrode terminal 10 which makes a hat configuration is attached so that said hole 6 may be covered on said obturation plate 7.

[0025] The relief valve 11 made of rubber is arranged so that said hole 6 may be closed in the space surrounded with said obturation plate 7 and said positive-electrode terminal 10. The circular pressure plate 12 which consists of an insulating material which has a hole in the center is arranged so that the height of said positive-electrode terminal 10 may be projected from said hole of the pressure plate 12 on said positive-electrode terminal 10. The sheathing tube 13 has covered the periphery of said pressure plate 12, the side face of said container 1, and the pars-basilaris-ossis-occipitalis periphery of said container 1.

[0026] Next, said positive electrode 2, a negative electrode 4, a separator 3, and the electrolytic solution are explained.

[0027] 1) a positive electrode 2 -- this positive electrode 2 contains the nickel compound which is an active material.

[0028] As said nickel compound, nickel hydroxide, zinc, and cobalt can mention nickel hydroxide or a nickel oxide etc. by which coprecipitation was carried out, for example. The nickel hydroxide with which coprecipitation of zinc and the cobalt was carried out especially is desirable.

[0029] Said positive electrode (paste type positive electrode) kneads with water the nickel compound and electric conduction material which are an active material, and a binder, prepares a paste, fills up a conductive axis with this paste, and it dries and it is produced by performing pressing if needed.

[0030] As said electrical conducting material, at least one or more sorts of things chosen, for example

from a cobalt compound and metal cobalt are used. As said cobalt compound, cobalt hydroxide [Co(OH)2], 1 cobalt oxide (CoO), etc. can be mentioned, for example. It is desirable to use cobalt hydroxide, 1 cobalt oxide, or such mixture as an electrical conducting material especially.

[0031] As said binder, rubber system PORIMA \*\* [, such as a hydrophilic polymer; latex, ], such as acrylic ester; polyvinyl alcohol [, such as cellulosic material; sodium polyacrylate, ], such as hydrophobic polymer; carboxymethyl celluloses, such as polytetrafluoroethylene, polyethylene, and polypropylene, methyl cellulose, and hydroxypropyl methylcellulose, and polyethylene oxide, can be mentioned, for example.

[0032] The metal porous body of the shape of the shape of reticulated [ which was formed as said conductive axis from the metal with which nickel, stainless steel or nickel plating was performed, for example ], and sponge, fibrous, or felt etc. can be mentioned.

[0033] 2) a negative electrode 4 -- general formula  $Ln_{1-x}Mgx(nickel_{1-y}Ty)_z$  (however,  $Ln(s)$  in a formula are a lanthanoids and at least one element chosen from calcium, Sr, Sc, Y, Ti, Zr, and Hf) which mentioned this negative electrode 4 above And at least one element with which the amount of  $La(s)$  occupied to  $Ln$  is ten to 50 atom %, and T is chosen from Li, V, Nb, Ta, Cr, Mo, Mn, Fe, aluminum, Co, Ga, Zn, Sn, In, Cu, Si, P, and B, x, and y and z contain  $0.05 \leq x \leq 0.20$ ,  $0 \leq y \leq 0.5$ , and the hydrogen storing metal alloy that shows  $2.8 \leq z \leq 3.9$  and is expressed, respectively.

[0034] said negative electrode (paste type negative electrode) -- for example, said hydrogen storing metal alloy powder, electrical conducting material, and binder are kneaded with water, a paste is prepared, and a conductive axis is filled up with this paste, and it dries and is produced by performing pressing if needed.

[0035] As said binder, having used with said positive electrode 2 and the same thing can be mentioned. As for this binder, it is desirable to carry out 0.5-6 mass section combination to said hydrogen storing metal alloy powder 100 mass section.

[0036] As said conductive ingredient, it is carbon BURATSU like ~~acetylene black~~ ~~KETCHIEN black~~ (trade name made from lion AGUZO), and furnace black, for example. KU or a graphite can be used. As for this electrical conducting material, it is desirable to blend below 5 mass sections to said hydrogen storing metal alloy powder 100 mass section.

[0037] As said conductive axis, the thing of the three-dimensional structures, such as 2-dimensional structures, such as punched metal, an expanded metal, a pierced steel plank, and a wire gauze, and foaming metal, a reticulated sintering metal fiber, can be mentioned.

[0038] 3) a separator 3 -- this separator 3 can mention what gave the hydrophilic functional group to a nonwoven fabric made from olefin system fiber like nonwoven fabrics made from olefin system fiber, such as for example, a nonwoven fabric made from a polyethylene fiber, a nonwoven fabric made from ethylene-vinylalcohol copolymer fiber, and a nonwoven fabric made from a polypropylene fiber, or the nonwoven fabric made from a polypropylene fiber, nylon 6, and a nonwoven fabric made from a polyamide fiber like 6. In order to give a hydrophilic functional group to said nonwoven fabric made from olefin system fiber, corona discharge treatment, sulfonation processing, graft copolymerization or a surfactant, spreading of hydrophilic resin, etc. are employable.

[0039] 4) As the alkali electrolytic solution of alkali \*\*\*\*\*\*, the mixed liquor of a sodium hydroxide (NaOH), the mixed liquor of a lithium hydroxide (LiOH) and a potassium hydroxide (KOH), and LiOH, the mixed liquor of KOH, LiOH, and NaOH, etc. can be used, for example.

[0040] The alkali rechargeable battery concerning this invention explained above General formula  $Ln_{1-x}Mgx(nickel_{1-y}Ty)_z$  (however,  $Ln(s)$  in a formula are a lanthanoids and at least one element chosen from calcium, Sr, Sc, Y, Ti, Zr, and Hf) And at least one element with which the amount of  $La(s)$  occupied to  $Ln$  is ten to 50 atom %, and T is chosen from Li, V, Nb, Ta, Cr, Mo, Mn, Fe, aluminum, Co, Ga, Zn, Sn, In, Cu, Si, P, and B, x, and y and z are equipped with the negative electrode containing  $0.05 \leq x \leq 0.20$ ,  $0 \leq y \leq 0.5$ , and the hydrogen storing metal alloy that shows  $2.8 \leq z \leq 3.9$  and is expressed, respectively. Since this negative electrode has high-capacity-izing and high corrosion resistance with said hydrogen storing metal alloy, it is high capacity and can obtain the alkali rechargeable battery which fills high charge/discharge capability and a longevity life to coincidence.

[0041]

[Example] Hereafter, the desirable example of this invention is explained to a detail with reference to a drawing.

[0042] (Examples 1-8 and examples 1-7 of a comparison) Each element of La, Ce, Pr, Nd, Mg, nickel, Co, Cr, Mn, and aluminum was mixed, and 15 sorts of hydrogen storing metal alloys which have the presentation shown in the following table 1 were manufactured by using a RF fusion furnace, and dissolving and cooling in an argon ambient atmosphere.

[0043]

Table 1

水素吸収合金組成	
比較例 1	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.76</sub> Mg <sub>0.24</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 1	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.81</sub> Mg <sub>0.19</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 2	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 3	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.91</sub> Mg <sub>0.09</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
比較例 2	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.96</sub> Mg <sub>0.04</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
比較例 3	(La <sub>0.05</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.75</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 4	(La <sub>0.10</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.70</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 5	(La <sub>0.40</sub> Ce <sub>0.04</sub> Pr <sub>0.15</sub> Nd <sub>0.41</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
比較例 4	(La <sub>0.55</sub> Ce <sub>0.03</sub> Pr <sub>0.14</sub> Nd <sub>0.28</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.3</sub>
実施例 6	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.5</sub> Co <sub>0.40</sub> Cr <sub>0.02</sub> Mn <sub>0.05</sub> Al <sub>0.03</sub> ) <sub>3.3</sub>
比較例 5	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.2</sub> Co <sub>0.62</sub> Cr <sub>0.04</sub> Mn <sub>0.08</sub> Al <sub>0.06</sub> ) <sub>3.3</sub>
比較例 6	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>2.7</sub>
実施例 7	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.5</sub>
実施例 8	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>3.8</sub>
比較例 7	(La <sub>0.25</sub> Ce <sub>0.05</sub> Pr <sub>0.15</sub> Nd <sub>0.55</sub> ) <sub>0.86</sub> Mg <sub>0.14</sub> (Ni <sub>0.8</sub> Co <sub>0.16</sub> Cr <sub>0.01</sub> Mn <sub>0.02</sub> Al <sub>0.01</sub> ) <sub>4.0</sub>

[0044] Each obtained hydrogen storing metal alloy was contained in the predetermined container, respectively, and the hydrogen absorption rate (H/M, h-1) after supplying hydrogen in each container under the temperature of 80 degrees C for 1 hour was measured. Consequently, the hydrogen storing metal alloys of the examples 1-7 of a comparison were 0.6 - 0.9 H/M and h-1 or more to the hydrogen storing metal alloys of examples 1-8 having been 0.9 H/M and h-1 or more.

[0045] Next, the nickel hydrogen rechargeable battery equipped with the negative electrode containing said hydrogen storing metal alloy is explained.

[0046] It homogenized by having heat-treated the hydrogen storing metal alloy (ingot) of the presentation shown in the <production of paste type negative electrode> aforementioned table 1, and through hydrogen storing metal alloy powder was obtained for the screen so that particle size might be set to 75 micrometers or less after grinding in an inert atmosphere. After continuing and adding as a binder with the carboxymethyl-cellulose (CMC) 0.2 mass section and the water 50 mass section in said each hydrogen storing metal alloy powder 100 mass section, 15 sorts of pastes were prepared by kneading. After continuing and filling up foaming nickel of 95% of porosity with said each paste, it dried at 125 degrees C, press forming was carried out to 0.3mm in thickness, and 15 sorts of paste type negative electrodes were produced by judging further in width of face of 60mm, and die length of 168mm.

[0047] To the mixed fine particles which consist of the <production of paste type positive electrode> nickel hydroxide powder 90 mass section, and the 1 cobalt-oxide powder 10 mass section, the

polytetrafluoroethylene 1 mass section and the carboxymethyl-cellulose 0.2 mass section were added, and the paste was prepared by carrying out 60 mass sections addition and kneading pure water at these. It continued, foaming nickel was filled up with this paste, and after drying, the paste type positive electrode with width of face of 60mm, a die length [ of 135mm ], and a thickness of 0.75mm was produced by carrying out press forming.

[0048] Subsequently, the nonwoven fabric made from a polypropylene fiber was infix between said each negative electrode and said positive electrodes, it wound spirally, and the electrode group was produced. After containing such each electrode group to a closed-end cylindrical cup, the electrolytic solution which consists of a potassium-hydroxide water solution of specific gravity 1.31 was poured in into said container, and the cylindrical shape nickel hydrogen rechargeable battery (capacity 4200mAh) of 15 sorts of 4 / 3A sizes which have the structure shown in drawing 1 mentioned above by performing obturation etc. was assembled.

[0049] About the rechargeable battery of the acquired examples 1-8 and the examples 1-7 of a comparison, 25 degrees C, On the conditions which charge at the rate of 10 time amount for 13 hours, and discharge to termination electrical-potential-difference 1.0V at 25 degrees C and the rate of 5 time amount, 3 cycle deed, On the conditions which charge for 6 minutes at 25 degrees C and the rate of 0.1 time amount after that, and discharge among termination electrical-potential-difference 1.0V at 25 degrees C and the rate of 0.1 time amount, 1 cycle deed, 5 cycle eye or subsequent ones was charged at 25 degrees C and the rate of 10 time amount for 10 hours at the pan, charge and discharge were repeated on the conditions which discharge to termination electrical-potential-difference 1.0V at 25 degrees C and the rate of 10 time amount, and initial capacity, the rate capacity of 0.1 time amount, and a cycle life were investigated. In addition, first-time discharge capacity was made into initial capacity, discharge capacity in the rate of 0.1 time amount was made into the rate capacity of 0.1 time amount to initial capacity, and the number of cycles when reaching 80% of capacity to initial capacity was made into the cycle life.

[0050] These results are shown in the following table 2.

[0051]

[Table 2]

	初期容量 m A h	0.1時間率容量 m A h	サイクル寿命
比較例 1	4112	1974	100
実施例 1	4126	2599	157
実施例 2	4138	2979	191
実施例 3	4117	2882	130
比較例 2	3933	2556	93
比較例 3	3852	2273	83
実施例 4	3986	2591	187
実施例 5	4126	2682	190
比較例 4	4084	2369	141
実施例 6	4021	2935	187
比較例 5	3571	2678	154
比較例 6	3718	1859	161
実施例 7	4111	2713	195
実施例 8	3997	2398	189
比較例 7	3776	2190	169

[0052] It is expressed with general formula  $Ln_{1-x}Mgx(\text{nickel}_{1-y}Ty)_z$  that it is clear from said Table 1 and 2. Ten to 50 atom % and x (the amount of Mg) the rechargeable battery of examples 1-8 with which the amount of La(s) occupied to Ln was equipped with the negative electrode containing the hydrogen storing metal alloy  $0 \leq y \leq 0.5$  and whose  $z$   $0.05 \leq z \leq 0.20$  and y (the amount of permutations to nickel) are  $2.8 \leq z \leq 3.9$  The amount of La(s) in Ln, It turns out that it has the initial capacity, the rate capacity of 0.1 time amount, and the cycle life in which x, and y and z were excellent compared with the examples 1-7 of a comparison equipped with the negative electrode containing the hydrogen storing metal alloy which separates from said range. It turns out that the rechargeable battery of examples 2, 4, 5, and 7 with which, especially as for the amount of La(s) in Ln, 20 to 40 atom % and x (the amount of Mg) were equipped with the negative electrode containing the hydrogen storing metal alloy  $0 \leq y \leq 0.2$  and whose  $z$   $0.10 \leq z \leq 0.15$  and y (the amount of permutations to nickel) are  $3.0 \leq z \leq 3.6$  is all excellent in initial capacity, the rate capacity of 0.1 time amount, and a cycle life compared with the examples 1-7 of a comparison.

[0053] In addition, even when the hydrogen storing metal alloy expressed with said general formulas other than the hydrogen storing metal alloy of a presentation used in the examples 1-8 is used, the alkali rechargeable battery in which the same outstanding property as examples 1-8 is shown can be obtained.

[0054] Moreover, in said example, although the example applied to the nickel hydrogen rechargeable battery of a cylindrical shape was explained, it is applicable also like the nickel hydrogen rechargeable battery of the configuration of the square shape which carries out the laminating of a positive electrode, a separator, and the negative electrode, and constitutes an electrode group.

[0055]

[Effect of the Invention] As explained above, it has the oxidation resistance which was excellent according to this invention, and has low temperature and hydrogen absorption nature high at an elevated temperature, and sufficient hydrogen storage capacity can be maintained in the repeat of occlusion and emission, and the hydrogen storing metal alloy which has a still higher hydrogen absorption rate can be offered.

[0056] Moreover, the long alkali rechargeable battery of a charge-and-discharge cycle life can be offered, having a negative electrode containing the hydrogen storing metal alloy which has said outstanding property, and realizing high capacity-ization according to this invention.

---

[Translation done.]